E-TASC General Meeting, 14th November 2024, Garching, Germany

EUROfusion Standard Software: Steps forward and role of ACHs

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on behalf of ACH PIs and teams

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Outline

- Objectives
- Criteria to monitor progress towards EUROfusion Standard Software
- Progress so far towards EUROfusion Standard Software
- Suggested next steps
  - Possible coordinated actions
  - Proposed new tier levels for EUROfusion standard software
  - Suggested first actions by end of January 2025
- Role of ACHs
- Conclusions

Objectives

- ensure that each candidate TSVV code makes best possible progress towards qualifying as EUROfusion standard software by the end of 2025
- plan and organize support actions (if needed) in 2025 and beyond

Criteria to monitor progress towards EUROfusion Standard Software

1. SOFTWARE ENGINEERING

1.1 Version control implemented

1.2 Software engineering standards (incl. continuous integration and regression/units tests) established

1.3 Coding standards (facilitating code maintainability and portability) established; this includes the use of modern programming languages and compilers

1.4 Performance optimization on HPC systems

2. CODE INTERFACES

2.1 User-friendly interface (e.g., GUI) for easy code handling

2.2 Post-processing and visualisation tools as a part of the code releases

2.3 Interface to the IMAS Data Dictionary

3. VERIFICATION, VALIDATION AND UNCERTAINTY QUANTIFICATION (VVUQ)

3.1 Specific plans for code verification, inter-code benchmarking, and code validation

3.2 Code verification studies accomplished, reports/papers available for download

3.3 Inter-code benchmarking accomplished, reports/papers available for download

3.4 Code validation studies accomplished, reports/papers available for download

Criteria to monitor progress towards EUROfusion Standard Software (continued)

4. CODE DISSEMINATION

4.1 Up-to-date release version of the source code available on the Gateway for download

4.2 Trainings provided to code users within EUROfusion

5. CODE DOCUMENTATION

5.1. High-quality technical documentation (including a detailed description of the underlying model) available for download

5.2. User manual available for download

6. USER SUPPORT

6.1 Responsive support team (involving code developers) in place

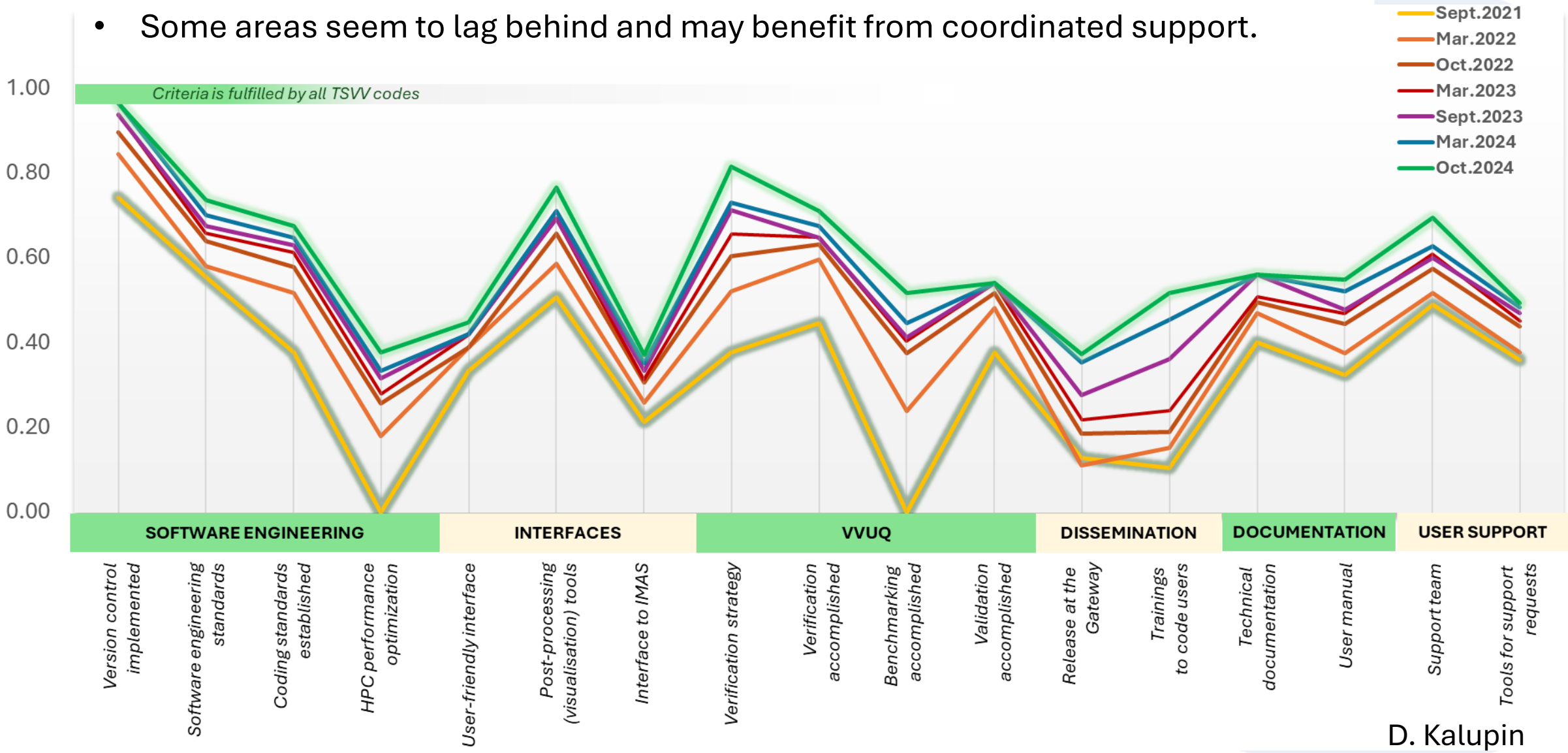
6.2 Tools for managing support requests (mailing list, issue tracker etc.)

Progress on each criteria quantified using “traffic light” system:

- not started
- in progress
- completed
- not applicable

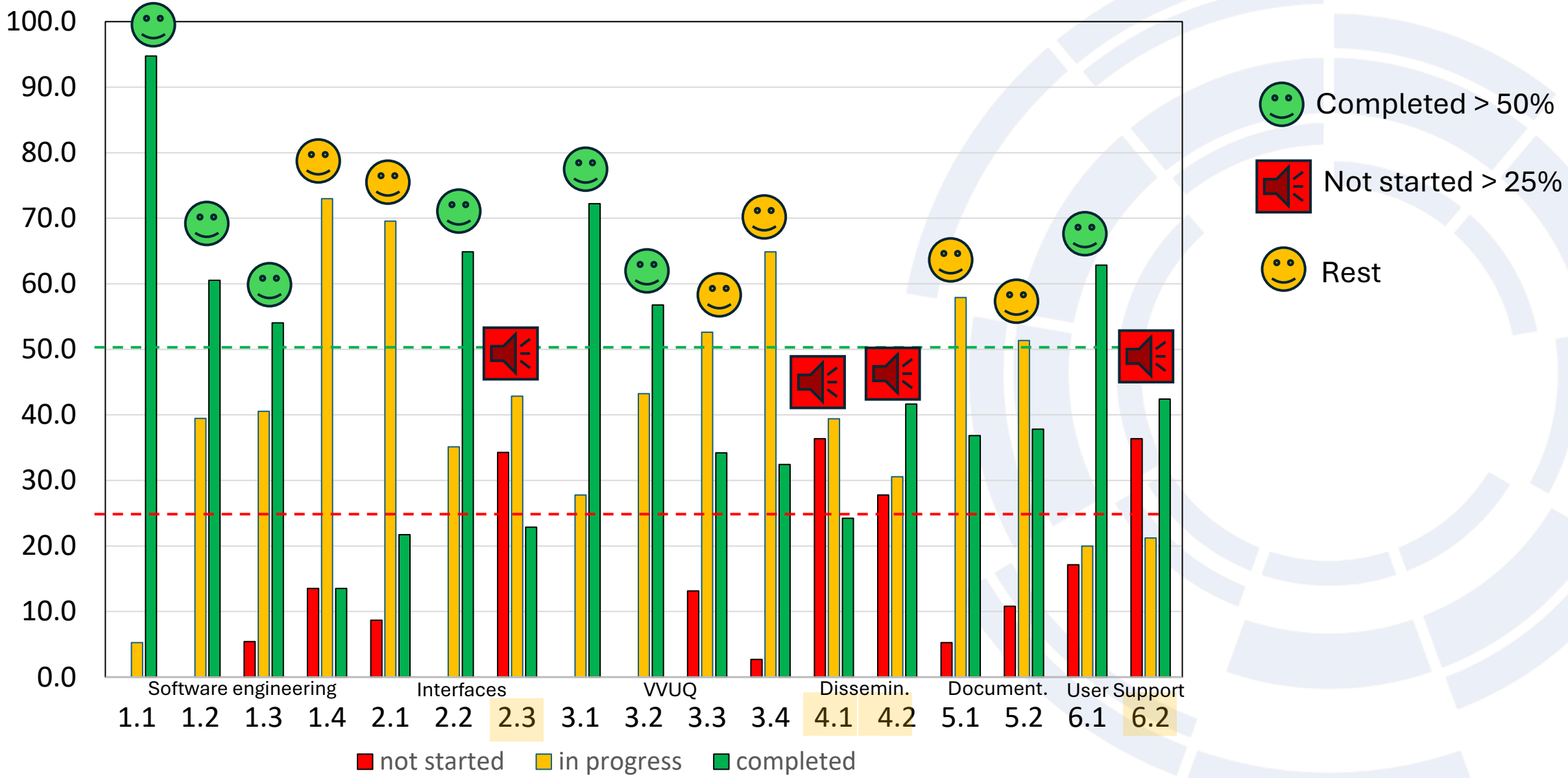
Progress of TSVV codes towards EUROfusion Standard Software

- There has been significant progress in all areas.
- Some areas seem to lag behind and may benefit from coordinated support.



D. Kalupin

Closer look at the status of work per criteria (October 2024)



Criterias with  (work not started for more than 25% codes)

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Possible coordinated actions to progress further; please share your ideas!

In red criterias with 

Possible action \ Criteria addressed	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	5.1	5.2	6.1	6.2
Offer servers with automated testing frameworks	X	X															
Establish documentation standards		X	X											X			
Establish a guide of best programming style			X														
Encourage meetings between developers and experts in profiling and benchmarking tools				X													
Version control and documentation	X													X			X
Offer training sessions and workshops for developers			X											X			
Keep documentation updated		X												X	X		
Collaborative development environment	X												X				X

EUROfusion tools for code development (CI/CD, version control etc) presented and demonstrated in earlier sessions.

Possible coordinated actions to progress further; please share your ideas!

In red criterias with 

Possible action \ Criteria addressed	1.1	1.2	1.3	1.4	2.1	2.2	2.3	3.1	3.2	3.3	3.4	4.1	4.2	5.1	5.2	6.1	6.2
Organize training events or webinars		X	X											X			
Research new programming models to abstract from the hardware platforms			X	X													
Integrate a member of the ACH team in the developer team of a code		X	X											X		X	
Create projects to clean codes		X	X														
Adopt a set of tools for post-processing and result visualization as standards for EUROfusion						X											
Create and use an online repository accessible for public download									X			X					
Include a validation section in the code reports										X							
Prepare / participate in online training modules and hands-on workshops												X	X				
Include a FAQ section in the code manuals															X	X	

Proposed new tier levels for EUROfusion standard software: tier 1 (minimum), tier 2, tier 3 (top)

DRAFT FOR DISCUSSION

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As of October 2024, there is one TSVV code that reaches tier 1 (minimum). This is 2.6 % of all TSVV codes (38).

Suggested first actions by end of January 2025

- E-TASC SB invited to endorse the tier levels.
- TSVV code developer teams, in consultation of respective ACH(s), invited to review their code with respect to tier levels and to define next steps to maximize progress in 2025:
  - If a code is not yet at tier 1 (minimum), define steps to get there by end of 2025.
  - If a code is already at tier 1, define steps how to progress further.
  - Recommendation: use SMART goals (Specific, Measurable, Achievable, Relevant, and Time-Bound).
- Indicate bottlenecks, if any, and support that could be helpful (actions listed on slide 7 or others)
- We suggest that PMU collects the info and coordinates joint follow-up actions where needed

On the role of ACHs

- ACHs are available to support the development of EUROfusion standard software in close collaboration with code developer teams.
- ACH work in 2025 will be defined by E-TASC SB next week (19th of November).
    - Requests for ACH support in 2025, gathered via the annual call, do not include specific actions for supporting the production of EUROfusion standard software.
    - While these requests are enough to fully book ACHs' available resources in 2025, it may be prudent to plan some contingency for specific support related to EUROfusion standard software.
- ACHs look forward to assessing specific support needs to produce EUROfusion standard software (output from suggested action discussed above) and whether, and if so, how it is possible to address them with the present expertise profiles in the ACHs.
    - If not, external collaborations/experts or additional expertise within ACHs would need to be sought.
    - To make new ACH recruitment processes viable and to keep present ACH expertise, confirmation of the extension of the ACHs until the end of 2027 is required.

Conclusions

- There has been good progress towards EUROfusion standard software.
- Further push in 2025 and beyond is recommended to include:
    - Further precision in the definition of criterias used for EUROfusion standard software by introduction of tier level system
    - Assessment of each candidate code's status, 2025 objectives and any support need with respect to qualifying as EUROfusion standard software.
    - Assessment of needs of coordinated support actions and planning how they could be met with the available resources.

Thank you for your attention

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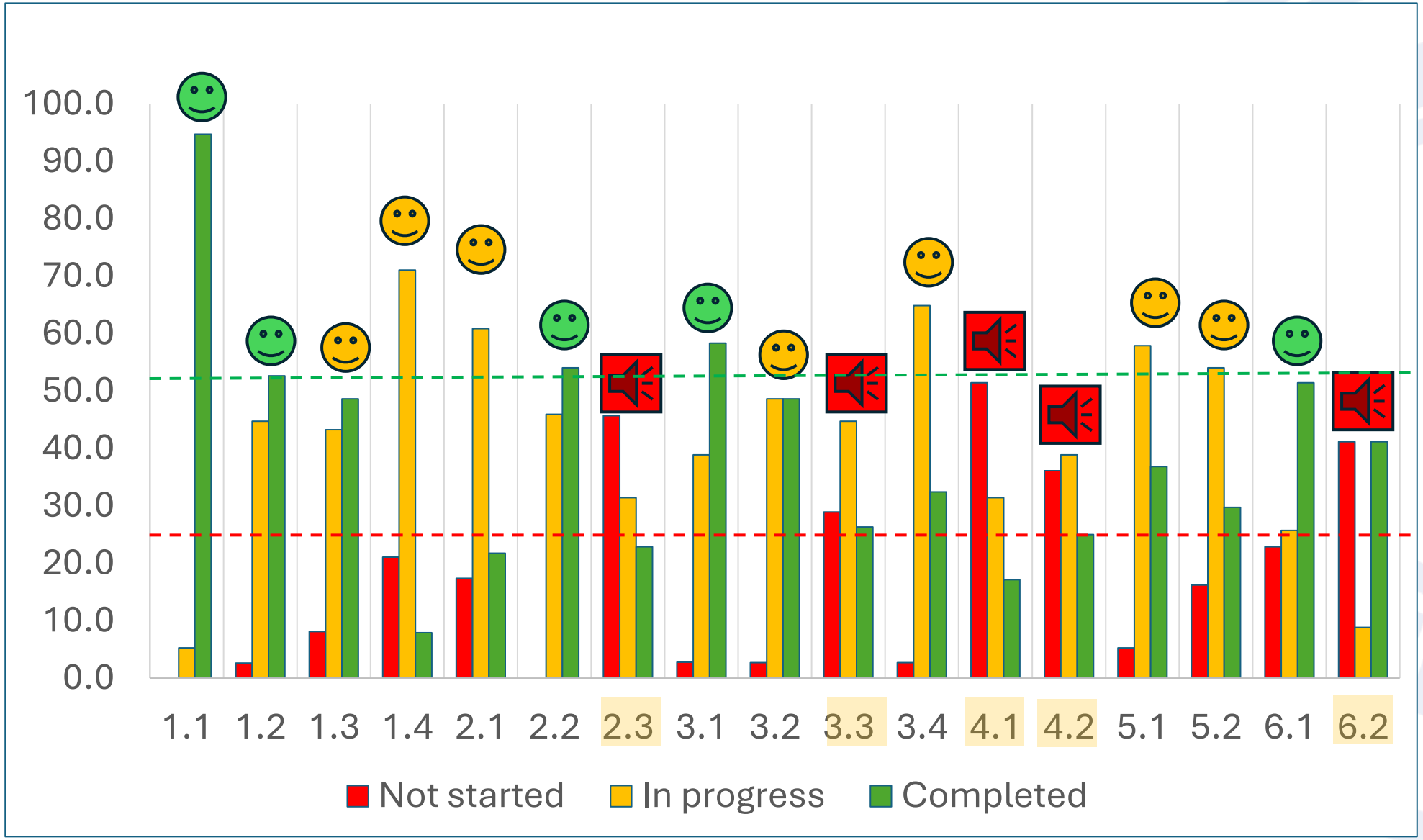
Invitation to the 5th Fusion HPC Workshop

Where: Online, free for all

More details & registration: **hpcfusion.bsc.es**

BACK-UP SLIDES

Closer look at the status of work per criteria (March 2024)



Guidelines for EUROfusion Standard Software

- **Free availability (within EUROfusion)** of an up-to-date release version of the source code used for production runs
- **Good software engineering practices** (version control, regression/unit testing, shared development rules etc.)
- High-quality **code documentation** via user manuals and reference publications (including, in particular, a detailed description of the underlying model)
- Excellent **support of users, co-developers, and support staff** within EUROfusion (via contact person, mailing list, issue tracker, and the like)
- Specific **plans for code verification and validation** (involving a third party), in particular within EUROfusion, including aspects of **uncertainty quantification**
- User-friendly, intuitive **interfaces and visualisation/post-processing tools, including interfaces to the IMAS Data Dictionary (where applicable)**
- Specific **plans for code dissemination and user training** within EUROfusion

General recommendations from TSVV mid-term review

- *"...increased focus on the development of EUROfusion Standard Software.... Shift to cross-code fertilization, the completion of the IMASification, and the dissemination of the developed tools."*
- *"TSVV projects need to place sufficient emphasis on issues like code documentation, code repositories, user training etc."*
- *"Code developers within the TSVVs and ACH team members must collaborate closely to achieve the desired results. Each side must make concrete commitments."*
- *"Constant exchange of information between all involved parties for any given code project. The criteria for EUROfusion Standard Software will be brought to the attention of the TSVVs and ACHs on a regular basis, and the progress along these lines will be continually monitored."*

Outcomes from ACH mid-term review

- *"It is crucial to view the collaboration between the ACHs and the code developers as a partnership, with both sides contributing resources to deliver successful outcomes."*
- *"The following areas of competence may need to be expanded within the existing ACH ecosystem:*
  - ***Data.** There is a need for increased expertise in the development, coordination, and IMASification of databases. (This presupposes the existence of a Long-Term Data Storage Facility.)*
  - *2. ***AI/ML.** Expanding ACH competencies in AI/ML will facilitate the implementation of technologies for data validation, analysis, and optimization.*
  - *3. ***New HPC technologies.** The ACHs need to expand their competencies to effectively adapt to the continuing evolution in HPC hardware/software.*
  - *4. ***Professional software engineering.** Facilitate the development of high-quality software that will fully meet the standards for the EUROfusion software stack."*

  *"This could involve **collaborating with external experts** to acquire the necessary skills."*

- *"Specific recommendation for ACH coordinators: Accelerate the development of the agreed-upon standards for the EUROfusion software stack by promoting professional software engineering practices."*